Claims

[c1]   What is claimed is:

1. A method comprising the steps of:

applying at least one SSFP pulse sequence to acquire MR data for at least one volume of data for an anatomy of interest; and

acquiring MR data for the at least one volume in an elliptic centric phase encode order.

[c2]   2. The method of claim 1 further comprising the step of purposely disrupting steady-state conditions of a first volume after acquisition of the first volume to reduce oscillatory transient signals in a second volume.

[c3]   3. The method of claim 2 wherein the at least one SSFP pulse sequence includes a first SSFP pulse sequence to acquire MR data for the first volume and a second SSFP pulse sequence to acquire MR data for the second volume, and comprising the step of acquiring MR data for the first volume in a reverse elliptic centric phase encode order and acquiring MR data for the second volume in an elliptic centric phase encode order.

[c4]   4. The method of claim 3 wherein a phase increment of

RF pulses at each TR of the first SSFP pulse sequence differs from that of RF pulses of the second SSFP pulse sequence.

[c5] 5. The method of claim 4 further comprising the step of changing the phase increment of the RF pulses of the first SSFP pulse sequence to the phase increment of the RF pulses of the second SSFP pulse sequence after MR data acquisition of the first volume.

[c6] 6. The method of claim 5 further comprising the step of playing out one or more dummy acquisitions between acquisition of the first and the second volumes.

[c7] 7. The method of claim 6 further comprising the step of modulating the RF phase increment every TR during the one or more dummy acquisitions to reduce pre-steady state oscillations in MR signals from spins in the second volume.

[c8] 8. The method of claim 7 wherein the step of modulating includes the step of non-instantaneously transitioning the phase increment of the RF pulses of the first SSFP pulse sequence to the phase increment of the RF pulses of the second SSFP pulse sequence between acquisition of the first and the second volumes.

[c9] 9. The method of claim 8 wherein the step of non-

instantaneously transitioning includes the step of gradually ramping the phase increment of the RF pulses of the first SSFP pulse sequence to the phase increment of the RF pulses of the second SSFP pulse sequence.

[c10]   10. The method of claim 9 wherein the transition between the phase increment of the RF pulses of the first SSFP pulse sequence and the phase increment of the RF pulses of the second SSFP pulse sequence is linear.

[c11]   11. The method of claim 2 further comprising the step of imaging the first volume before imaging the second volume.

[c12]   12. The method of claim 2 configured for at least one of internal auditory imaging, cervical spine or cartilage imaging.

[c13]   13. The method of claim 2 configured to reduce transient oscillatory signals from resonance and off-resonance spins.

[c14]   14. An imaging protocol to image a first and a second volume, the protocol comprising:
a first SSFP pulse sequence configured to acquire MR data for a first volume in a reverse centric phase encode order;
a second SSFP pulse sequence configured to acquire MR

data for a second volume in a centric phase encode order; and

a discarded acquisitions segment configured to be played out after the first SSFP pulse sequence and before the second SSFP pulse sequence.

[c15] 15. The imaging protocol of claim 14 wherein RF pulses of the first SSFP pulse sequence have a first phase increment different from a second phase increment of RF pulses of the second SSFP pulse sequence.

[c16] 16. The imaging protocol of claim 15 wherein the discarded acquisitions segment has a temporal length sufficient to allow ramping of the first phase increment to the second phase increment.

[c17] 17. The imaging protocol of claim 16 wherein the first phase increment and the second phase increment are linearly related.

[c18] 18. The imaging protocol of claim 14 wherein a center of k-space for the first volume is acquired in close temporal proximity to a center of k-space for the second volume.

[c19] 19. An MR apparatus comprising:

a magnetic resonance imaging (MRI) system having a plurality of gradient coils positioned about a bore of a

magnet to impress a polarizing magnetic field and an RF transceiver system and an RF switch controlled by a pulse module to transmit RF signals to an RF coil assembly to acquire MR images; and

a computer programmed to:

generate and cause application of a phase-cycled SSFP pulse sequence to acquire MR data for a first and a second volume of data for the anatomy of interest;

acquire k-space of the first volume in a reverse centric phase encode order; and

acquire k-space of the second volume in a centric phase encode order.

[c20] 20. The MR apparatus of claim 19 wherein the computer is further programmed to play out a series of discarded acquisitions after acquisition of k-space for the first volume.

[c21] 21. The MR apparatus of claim 20 wherein the phase-cycled SSFP pulse sequence includes a series of RF pulses that have a first phase increment for data acquisition of the first volume and a second phase increment for data acquisition of the second volume.

[c22] 22. The MR apparatus of claim 21 wherein the computer is further programmed to adjust the first phase increment to the second phase increment while the series of

discarded applications are played out.

[c23]   23. The MR apparatus of claim 22 wherein the computer is further programmed to ramp down the first phase increment to the second phase increment at a temporal rate that does not cause oscillations in MR detectable signals of the second volume as the second volume is brought to a steady-state.

[c24]   24. The MR apparatus of claim 23 wherein the temporal rate is sufficient to prevent oscillations in MR signals detectable from off-resonance spins of nuclei in the second volume.

[c25]   25. The MR apparatus of claim 23 wherein the computer is further programmed to acquire a center of k-space for the first volume in close temporal proximity to a center of k-space for the second volume.

[c26]   26. A computer readable storage medium having a computer program stored thereon and representing a set of instructions that when executed by a computer causes the computer to:
cause application of a first SSFP pulse sequence to acquire data for a first volume, wherein RF pulses of the first SSFP pulse sequence have a first phase increment;
acquire MR data for the first volume in a reverse centric

phase encode order;

cause application of a second SSFP pulse sequence to acquire data for a second volume, wherein RF pulses of the second SSFP pulse sequence have a second phase increment, the second phase increment being different than the first phase increment; and

acquire MR data for the second volume in a centric phase encode order.

[c27]   27. The computer readable storage medium of claim 26 wherein the set of instructions further causes the computer to play out a series of dummy RF pulses prior to application of the second SSFP pulse sequence.

[c28]   28. The computer readable storage medium of claim 27 wherein the set of instructions further causes the computer to cause a change from the first phase increment to the second phase increment while the dummy RF pulses are played out.

[c29]   29. Th e computer readable storage medium of claim 26 wherein the set of instructions further causes the computer to purposely disrupt a steady-state of spins in the anatomy of interest to reduce oscillation of spins in the second volume as the anatomy of interest is brought to a new steady-state.

[c30]   30. The computer readable storage medium of claim 26 incorporated in a computer data signal embodied in a carrier wave that is uploadable/downloadable to an MR imaging system that when executed by a computer causes execution of the set of instructions.